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We are pleased to introduce you to Fraunhofer TechFlash - Fraunhofer's Flash News on latest and exciting technologies.

This week's TechFlash is about some recent technology developments at [Fraunhofer Research Fab Microelectronics Germany \(FMD\)](#), which are mentioned below:

1. Terahertz technologies for visionary innovations in communications and sensor technology
2. Detecting faults in overhead power lines with AI
3. New bonding technologies for wafer-level packaging and 3D heterointegration
4. Reliable microelectronics through failure analysis with Artificial Intelligence

The [Fraunhofer Research Fab Microelectronics Germany \(FMD\)](#) is a cooperation between the Fraunhofer Group for Microelectronics and the Leibniz institutes FBH and IHP. FMD networks the research and development infrastructure as well as the technological know-how of its eleven member Fraunhofer institutes and is, therefore, the leading provider of applied research, development and innovation in the field of micro- and nanoelectronics in Germany and Europe. FMD offers R&D services, application solutions and new technologies at a high level of technical maturity from a single source to a broad customer base. FMD already offers innovative answers to future questions in the areas of transportation & mobility, health, energy, digital industry, digital life, and civil & occupational safety. In doing so, FMD combines state-of-the-art technologies from the fields of sensor systems, extended CMOS, microwave & terahertz, power electronics, MEMS actuators and optoelectronic systems into novel solutions and prepares them for application. Through its structure as a one-stop shop, FMD offers all this from a single source, serving as a central point of contact for its customers and partners.

[Terahertz technologies for visionary innovations in communications and sensor technology](#)



In the recently launched joint project "T-KOS" of the Research Fab Microelectronics Germany (FMD), terahertz technology is now to be developed synergistically for industry in the fields of communication and sensor technology for the first time. Innovative system solutions in both areas can make a significant contribution to the successful implementation of future issues such as digitalization, Industry 4.0 or resource efficiency and thus strengthen Germany as a business location in the long term.

In our digitalized, high-tech world of life and work, the availability of communications and data connections is a basic requirement. The increasing mobility of users, the flexible use of broadband multimedia content (e.g., entertainment, medicine, logistics), and future technologies such as the Internet of Things or autonomous driving are increasing both the volume of data in mobile networks and the demands on the communications networks themselves. One promising option for increasing data capacity and usable bandwidth is the additional use of terahertz technologies. This forms the basis for innovation not only in the area of radio systems, but also in the area of non-destructive testing (NDT). Terahertz waves can penetrate most electrically non-conductive materials, such as ceramics or plastics, in a similar way to ultrasound and X-rays, but they operate without a coupling medium and require neither complex mechanical guidance nor radiation protection measures because, unlike X-rays, they are harmless to the human organism.

We look forward to hearing of your interest to discuss your requirement.

[Yes, I am interested](#)

[Detecting faults in overhead power lines with AI](#)



The control and maintenance of overhead lines will be supported by AI in the future

50Hertz and two Fraunhofer member institutes of the Fraunhofer Research Fab Microelectronics Germany (FMD) join forces to test technologies in the field of Artificial Intelligence (AI) in order to detect fault on overhead lines earlier and therefore fix them more efficiently. Their objective is to have algorithms automatically assess the recordings from different inspections. The name of the project is CoDro.

CoDro stands for Common Algorithms for Autonomous Drones Operation. This way, continuous static monitoring is developed by means of high-resolution static images of overhead power lines. Based on these image data, AI algorithms and trained neural networks can locate and classify possible defects. A first test was carried out for corrosion damage on pylons.

The two FMD member institutes in Berlin, the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute (HHI) and the Fraunhofer Institute for Reliability and Microintegration (IZM) contribute their professional expertise to this 50Hertz project. While Fraunhofer HHI is responsible for the AI-based automatic detection of corrosion faults, Fraunhofer IZM is working on the image database, the labelling/annotation tool and the web platform. In parallel, 50Hertz is providing extensive image material gathered during drone and helicopter flights for the creation of the database. A web-based tool for labelling and image management has already been developed from these images.

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[Yes, I am interested](#)

[New bonding technologies for wafer-level packaging and 3D heterointegration](#)



high-vacuum bonder facility

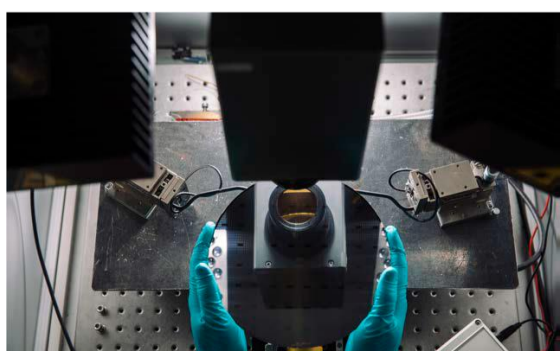
One of the new high-tech devices – a high-vacuum bonder that helps, among other things, to reduce the high temperatures during bonding and thus protects the components.

A novel surface treatment based on plasma cleaning combined with processing of the wafers under ultra-high vacuum enables oxide-free Al-Al wafer bonding. As a result, the temperatures during bonding can be reduced enormously to approx. 150 °C. This protects the components and reduces thermomechanical stresses during bonding. Another special feature: optical alignment with a very high accuracy of less than 1 µm enables the production of electrically conductive Al interconnects with ultra-fine dimensions between the substrates. With the help of this new bonding technology, future-oriented possibilities arise in the area of wafer-level packaging and 3D heterointegration, in which different semiconductor technologies can be combined to obtain higher functionality and performance.

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[Yes, I am interested](#)

[Reliable microelectronics through failure analysis with Artificial Intelligence](#)



Non-destructive diagnostic methods such as lock-in thermography

In current failure analysis workflows, numerous methods are used that provide complementary analysis data from components. However, these have so far only been linked manually. The automated, cross-process provision and AI-based evaluation of this data, including derivation of failure causes, have enormous potential to further increase the efficiency of quality control in manufacturing and thus increase product reliability and quality with ever shorter development times. The use of machine learning methods offers novel possibilities for automating and thus increasing the efficiency of failure diagnostics. The new methods based on artificial intelligence (AI) will help to capture and evaluate complex failure modes.

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[Yes, I am interested](#)

About Fraunhofer-Gesellschaft:

The Fraunhofer-Gesellschaft, headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for ground-breaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 76 institutes and research institutions throughout Germany. The majority of the organization's 30,000 employees are qualified scientists and engineers, who work with an annual research budget of 3 billion euros. Of this sum, 2.5 billion euros is generated through contract research. Our global footprint is very strong, with offices and research centres in the USA, Europe and Asia. Some of our renowned innovations are the MP3 software, white LED's and the smallest of cameras.

Fraunhofer has been a long-time trusted innovation partner in India, collaborating with some of the major players in the field of Material Science, Energy, Environment, Automotive, Electro-mobility, Production Technology and Smart Cities, working with Industry, Government and Public Sector.

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